UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1201 ELM STREET, SUITE 500
DALLAS, TEXAS 75270

March 15, 2022

Robyn Strickland, Director
Oil and Gas Conservation Division
Oklahoma Corporation Commission
P.O. Box 52000-2000
Oklahoma City, OK 73152-2000
Robyn Strickland <Robyn.Strickland@occ.ok.gov>

Dear Ms. Strickland:

Enclosed is our evaluation of the Oklahoma Corporation Commission (OCC's) Class II Underground Injection Control (UIC) program performance during state fiscal year 2021 (FY21). By e-mail on February 28, 2022, we invited OCC comments on the draft evaluation, and all suggested changes were addressed as of March 14, 2022.

EPA commends OCC on creating the Permian restricted area to help improve the protection of Underground Sources of Drinking Water (USDWs). However, the EPA is concerned that stricter controls on the production side of oil and gas activities may be required to resolve the seismicity issues fully. EPA is continually impressed with OCC and its endeavors in improving its permitting process.

We thank you and your staff for your efforts in the implementation of this challenging program. We consider our open dialogue a key component of effective communication between our agencies. If you have any questions on the evaluation report or the revision requests, you may contact Troy Hill, my Deputy Director at (214) 665-6647, or your staff may call Jim Brown or Ken Johnson of my staff at (214) 665-7150.

Sincerely,

Charles W. Maguire
Director
Water Division

Enclosure

cc: Patricia Downey, OCC UIC Manager, w/encl. (Patricia.Downey@occ.ok.gov)
Mike McGinnis, OCC Deputy Director, w/encl. (Mike.McGinnis@occ.ok.gov)
Charles Lord, OCC Manager Induced Seismicity Manager, w/encl. (Charles.Lord@occ.ok.gov)
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End-Of-Year (EOY) Review

Oklahoma Corporation Commission (OCC)
Underground Injection Control (UIC) Program

State Fiscal Year 2021 (SFY2021)
July 1, 2020, through June 30, 2021

INTRODUCTION

EPA has approved the Oklahoma Corporation Commission (OCC) as the primary enforcement agency for the State's Class II Underground Injection Control program since 1981. Simultaneously, the Oklahoma Department of Environmental Quality (ODEQ) implements the applicable State UIC program for all other injection wells in Oklahoma. EPA retains primary authority for Class I, III, IV, and V on certain Indian Lands and Class II on some Indian Lands not under the authority of OCC. This annual review considers the approved State UIC program administered by OCC, including the UIC grant work plan and other program activities, between July 1, 2020, and June 30, 2021.

EPA is in the process of creating a new methodology for internal and oversight reviews across all programs. The first part of the process defines an 'Annual Check-In' between EPA and the permitting authority to discuss and agree on planned oversight topics for the following year. The basis of the check-in meeting would be the upcoming fiscal year's agreed Workplan, focusing on the items to be reported to EPA and items on which we will be concentrating our oversight. Currently, no changes in oversight from the approved 2021 Workplan are planned.

Plans also include using existing 7520 reporting data and inventory numbers. HQ may utilize prebuilt Qlik graphs (part of the same online reporting system) to conduct national comparisons among various delegated permitting programs. It is not sure whether this is for internal reporting or the primacy agency report, but we wanted to let you know of the discussions.

EPA representatives solicited comments on EPA's annual end-of-year (EOY) draft evaluation report with OCC via e-mail on February 28, 2022 and received several comments back which were incorporated. Appendix A contains OCC's annual narrative required in the UIC grant work plan.

OCC's Induced Seismicity Department continues to effectively manage induced seismicity, as demonstrated by the continued decrease in the number and severity of events. OCC is highly commended for its diligence and actions related to addressing seismicity in the state. The EPA would also like to acknowledge the OCC's staff cooperation and willingness to share information.

This report consists of five main sections: Introduction, Grant Work Plan, Special Issues, UIC Oversight Issues, Induced Seismicity, and Summary and Recommendations.

GRANT WORK PLAN

SFY2021UIC GRANT

OCC's applications for SFY2021 were for a total of $566,456 in Federal funds. EPA approved and awarded $287,000 as of the Federal 2021 allotment for the State of Oklahoma's UIC program administered by the OCC under G-00622421. Also, EPA awarded OCC $33,618 in UIC Special Project funds in SFY2021. However, OCC returned $69,746 due to unexpected retirements and there are no current plans to fill the position. Altogether, this brings the total awarded to $284,471. Work plan Deliverables: OCC submitted all required State program updates and other deliverables required during SFY2021.

As shown in Figure 1, the UIC grant allocation has gradually decreased over the last six years, however, a significant increase is seen last year, while inventory has decreased. Additionally, federal funding has been late due to federal budget issues on more than one occasion.

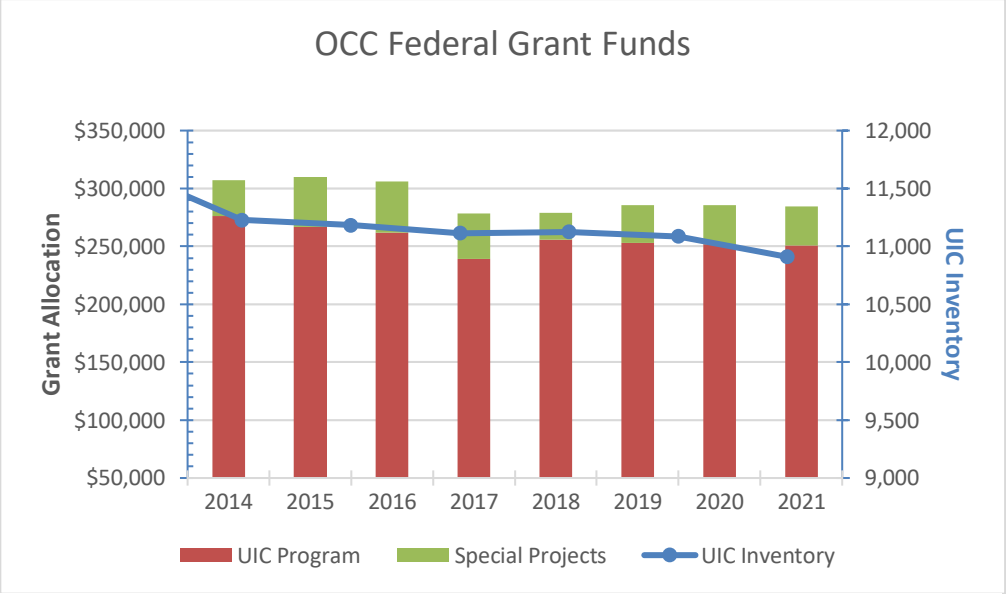


Figure 1: UIC Grant Funding

SPECIAL PROJECTS

EPA commends OCC on its continuing commitment to improving its information resource database through the Special Projects initiative to georeferenced archival aerial photos. The OCC Narrative in Appendix A describes the status of OCC's special projects for the year. The archival GIS library contains 121,234 aerials of the state. Georeferencing these aerials can be used by both EPA and the OCC in investigations. This project continues in FY2021; as of 7/02/2021, there are 42,078 georeferenced aerials. Close to an additional 475 archived images across the state have been georeferenced using part-time help funded through special projects. This georeferenced effort increases the easily usable historic images to 35% of those collected scanned under the earlier project phase.

MULTIPURPOSE GRANT

OCC UIC received a special Multipurpose grant (MPG) for the Brown Dolomite project, not connected to the regular OCC UIC FY2020 grant; the grant # was #AA-01F693-01. The grant was $65,273 in Federal Funds; no state matching funds were required or included.

SPECIAL ISSUES

OCC kept EPA apprised of Permian age (geological age) injection activities, notably in the Brown Dolomite from near the panhandle to central Oklahoma. The Permian period is prominent in the west and central Oklahoma, where Permian age sediments outcrop at the surface.

As reported in the EOY 2019 review, the EPA held a teleconference on September 5th, 2019, connecting the OCC staff with counterparts at the Texas Railroad Commission to discuss the situation. OCC shut in four saltwater disposal wells near a saltwater purge occurring at the Blaine-Kingfisher County border. Additional problems with saltwater coming to the surface have occurred further away. OCC UIC has limited injection volumes into Pennsylvanian age zones and stopped approving new disposal into Permian age zones within the 14,915 sq. mi. Permian restricted area. On December 6, 2019, OCC Chairman Hiett requested EPA staff assistance to advise and assist in this critical matter. EPA has been analyzing voluminous data OCC has acquired on the case and maintains close communication on the ongoing support through ongoing biweekly Teams meetings.

A significant number of actions and meetings were held in FY 2021 and will be briefly discussed. A 6-mile "no-injection" restriction zone on Permian age injection has been effectively in place for over a year. Only one operator has requested to resume injection as of October 25, 2021 and has pursued litigation. No ruling has been made as of this EOY. Through the considerable efforts of OCC staff, the purge, which at its max of 449.14 BPD on November 25th, 2019, has declined to a static level since August 9th, 2021. Future plans include monitoring the site for a calendar year; if no changes occur, OCC intends to fill the monitoring wellbore with gravel and cement on top. As with the seismicity issue, the in-depth look at this issue requires a practical application of several diverse specialized skill sets to complement OCC's existing staffs' abilities. Ideally, these would be with at least two staff dedicated to the special project and working with the operational and OCC staff to ensure the best outcome. Insights from the Brown Dolomite project highlighted these issues.

As with the seismicity issue, this problem has generated an enormous amount of data. While EPA understands a project to create a separate dashboard is under discussion, reformatting the data into useful information to act upon is critical. Data engineering with visualization may be a highly beneficial option. However, this is heavily time intensive as the data must be analyzed, reworked, and numerous scenarios evaluated. The benefits could include 3D graphics to clarify the problem and spatial statistical analysis.

EPA UIC OVERSIGHT ISSUES

EPA has expressed concerns with current financial surety requirements. However, OCC is addressing this concern through newly proposed legislation to increase surety requirements.

Additionally, OCC is to be commended for continually improving their permitting process, such as the requirement of corrective action for any problem well identified in AORs.

INSPECTIONS AND MECHANICAL INTEGRITY TESTS (MIT)

EPA commends OCC for its MIT program accomplishments, for witnessing most of the MITs and improved tracking of RATs for fluid migration beginning in SFY2018. OCC continues to conduct and witness (Appendix A(2)) annual mechanical integrity tests for over 20%, exact equals 32% for FY2021, of the inventoried injection wells. This practice results in OCC's success exceeding the minimum five-year MIT requirement for all wells in the inventory. Figure 2 shows various MIT and field metrics, including the number of MIT's witnessed and site inspections. Significant leak tests include pressure tests and monitoring records. Fluid migration tests include Radioactive Tracer and Cement Bond tests.

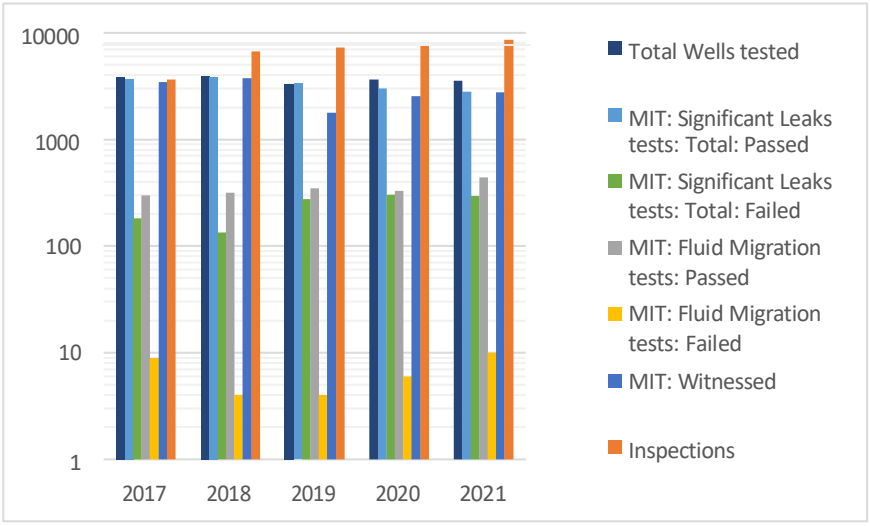


Figure 2: Mechanical Integrity

ENFORCEMENT ACTIONS

Figure 3 provides a summary of OCC enforcement actions. The absence of Monitoring violation and Reporting entries for years 2017 represents either a failure of RBDMS to provide the required information or erratic tracking that EPA did not catch at the time.

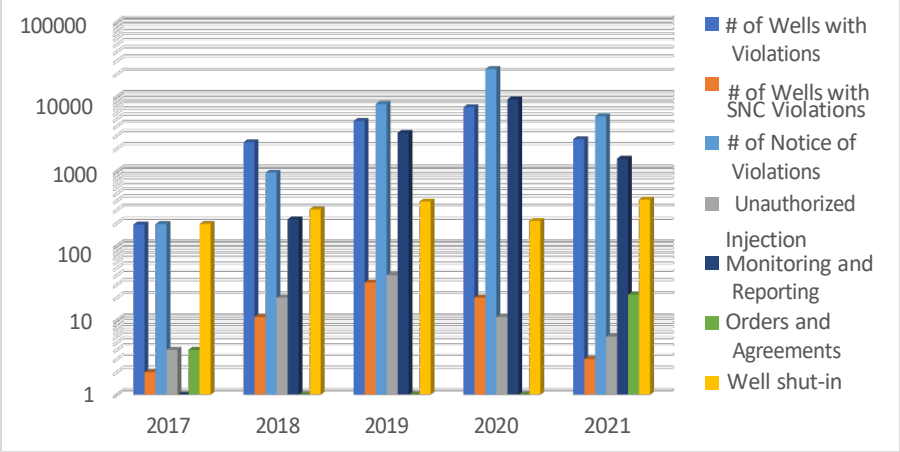


Figure 3: Enforcement Actions (SNC-Significant Non-Compliance)

INDUCED SEISMICITY

Currently, OCC's Induced Seismicity (IS) Department deals with ongoing issues with completion generated events in the Scoop and Stack play and a series of events near Quinton, Oklahoma, where a shallower injection zone may be in communication with the Arbuckle.

SUMMARY AND RECOMMENDATIONS

EPA commends OCC for continuing to clean up known data issues in RBDMS. EPA commends OCC on its recent proactive action to create a Permian restricted area to help improve the protection of Underground Sources of Drinking Water (USDWs). EPA is concerned that stricter controls on the production side of oil and gas activities may be necessary before there is any improvement. OCC Pollution Abatement initiated the appropriate response actions and has held both internal and joint EPA-OCC meetings on the topic. Within the limits of the existing framework of regulations, they have done very well.

While the technical analysis of the available purge-related data continues, it seems likely that the cause will be from a combination of issues. Issues may include local geology, past permitted historic production well construction practices, and allowing injection into formations that appear to be, in hindsight, inappropriate, whether through lack of reliable containment or by adding pressure to an already over-pressurized system. If analysis back those conclusions, OCC will be facing a difficult decision on whether rule changes or restrictions will help manage or reduce the likelihood of another purge

APPENDIX A: YEAR-END NARRATIVE
Oklahoma Corporation Commission
Underground Injection Control
Class II Wells
Year-End Narrative
Workplan 2021
7/1/2020-6/30/2021

Oklahoma Corporation Commission (OCC) implemented a successful Program in FY 2021 meeting or exceeding most of the established targets as determined in Workplan 2021. A summary of these activities is depicted in the "Annual Report Card" in Appendix A(2).

OCC will be returning $69,746 programmatic funds to EPA Region 6 this year. This was due to an unplanned retirement of a staff member that was included in our FY 2021 grant application and budget. The position remains unfilled and is the reason for the remaining funds that are being returned to EPA region 6.

OCC currently has an inventory of approximately 10,909 active UIC wells.

Total UIC applications and orders submitted were 314 for the year: 71 Disposals, 114 Injectors, 0 Annular, 3 SI, 16 Commercial Disposals, and 89 Exceptions to the rules, and 21 Emergency Orders. There were 215 UIC approved orders/permits this year: 47 Disposals, 73 Injectors, 0 Annular, 3 SI, 21 Commercial Disposals, and 49 Exceptions to the rules, 8 Interim Orders, and 14 Emergency Orders. Total number of dismissals was 215.

UIC inspections for 2021 were 9,154, which is higher than the target of 7,500. MIT's numbered 3,526 this year.

OCC UIC (UIC) staff continues to place an emphasis on the timely filing of 1012A forms (Annual Fluid Injection Reports) by operators in Oklahoma. Due to the efforts of UIC staff and a special project temp, 1012A filing compliance is 94% with all received reports processed into RBDMS. UIC continues to undertake the necessary due diligence to obtain any missing 1012A reports.

In FY 2021, UIC still required and processed the 1012D form. This is used for daily reporting of injection volume in seismically sensitivity areas of the state. The UIC Program continues to work closely with the Seismicity Team Members as UIC applications are processed, reviewed, approved, and monitored for compliance.

In the area of GIS, UIC continues to sustain the OCC's aerial photo library. We are current on all aerial photos from the NAIP. Currently, we have county wide aerial photos for the years 1995, 2003 - 2006,

2008 - 2010, and 2013 - 2020 in all 77 counties. These maps with well data are provided to our field inspectors, as the information is updated by our GIS specialist. All this data is available to the EPA.

In addition to the aerial photos from NAIP, OCC maintains an archival GIS library that contains 121,234 historical aerials of the state. This project has been aided by EPA through Special Project grants. The continued georeferencing of these photos produces historic time frames that can be used by UIC and the OCC in investigations. The aerial maps provide a more precise determination of well locations and a detailed record of past surface pollution. This project was still in progress in FY2021, as of 7/02/2021 there are 42,078 georeferenced aerials.

The Brown Dolomite Project was funded through a multipurpose grant that was tied to the UIC grant. This project had its own workplan but was implemented under the UIC QAPP. This grant was used to help fund the creation of a new FTE position to address the issue related to wells completed in the Brown Dolomite in central and western portions of the state. The OCC was able to employee an expert in petroleum engineering (Danny Ray) for this position. He has worked with EPA Region 6, agency staff, and operators in compiling data on the project area wells and the Brown-Dolomite formation. He continues to help the state address this issue by implementing processes to reduce and eliminate the purge issue related to the Brown-Dolomite formation. A report by Danny Ray's report on this project is included in Appendix B.

Appendix A(2)

Annual Report Card
UIC Program Activities
Workplan 2021
(7-1-20 through 6-30-21)

Activity	**Goals**	**Accomplishment**
Inspections (On-site)	7,500	9,154
MITs (total)	2,000	3,526
MITs (Witnessed)	1,700	3,074
Permits/Orders (Total Issued)	NA	215
Technical Reviews	NA	204
Operatorship Transfers	NA	301*
Technical Conferences	NA	32

Number represents total 1073i forms processed per well, both approved and rejected

Appendix B

Oklahoma Brown Dolomite Report to the EPA

written by

Danny Ray
Regulatory Program Manager
O&G Conservation Division
Oklahoma Corporation Commission

June 29, 2021

Oklahoma Brown Dolomite Report to the EPA

June 29, 2021

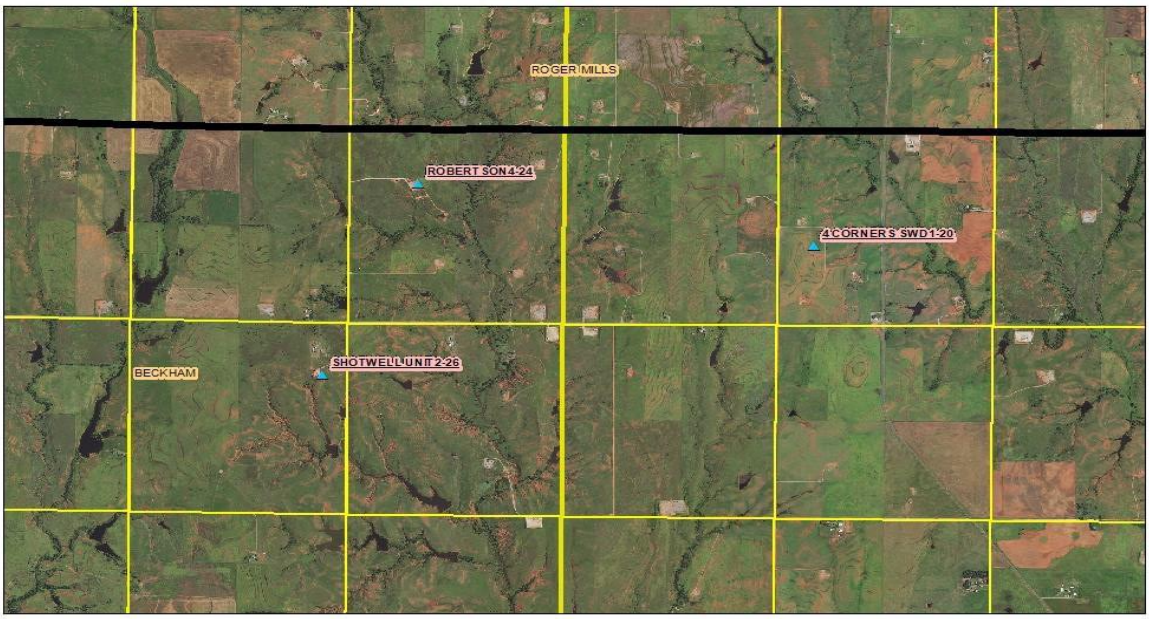
This report covers purges associated with Brown Dolomite disposal wells. I will begin with the most current understanding of the Brown Dolomite purges.

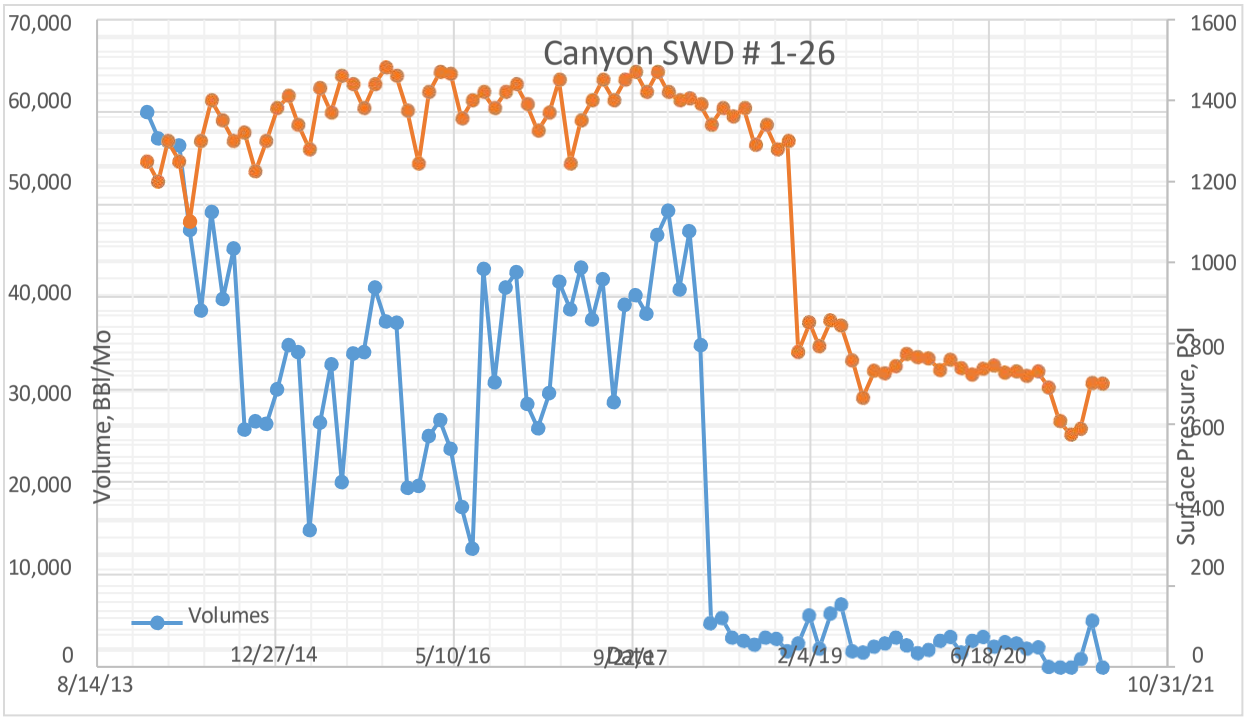
Brown Dolomite Issues

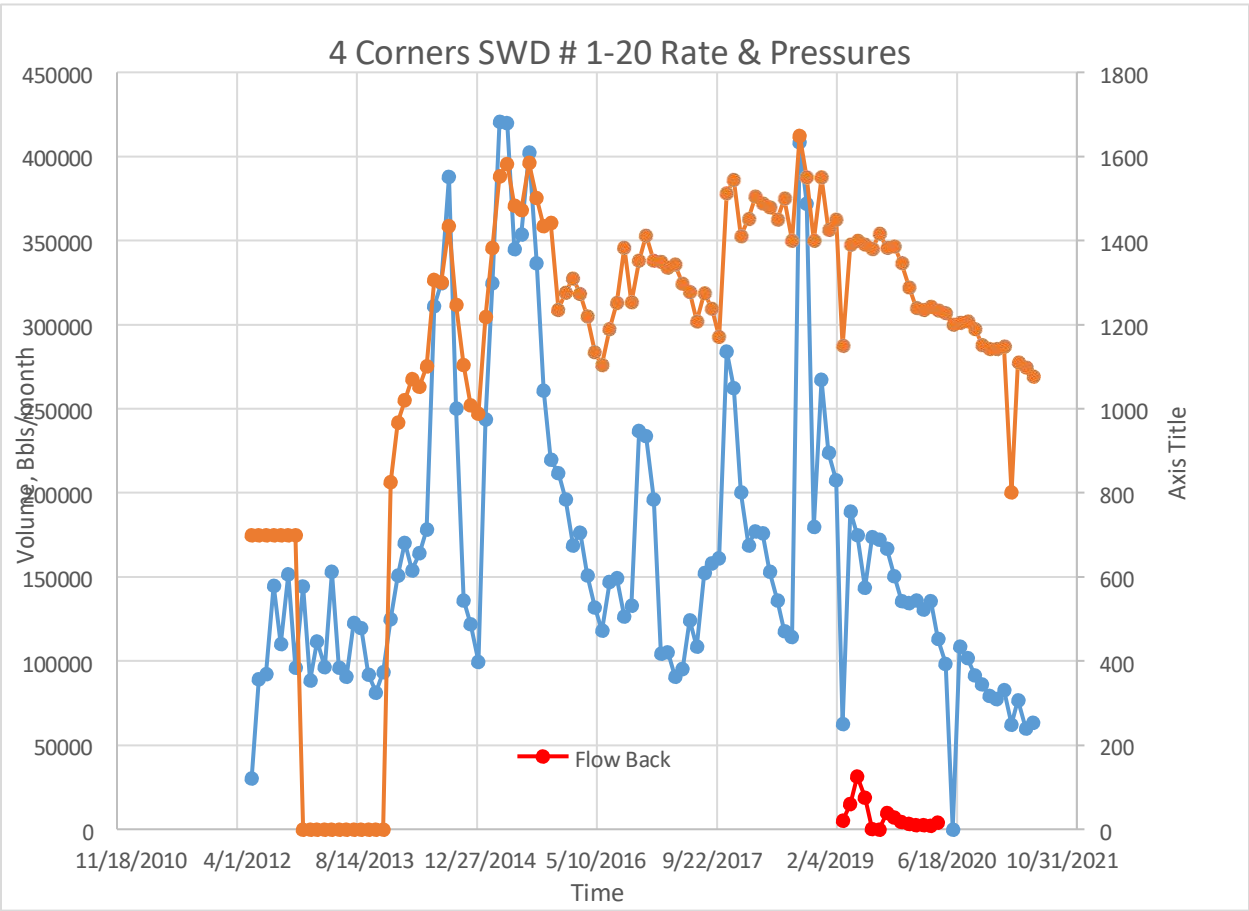
The Oklahoma UIC department currently oversees 149 Brown Dolomite disposal wells located in 21 of Oklahoma's 77 counties with the wells located primarily in northern and western parts of the State. The Brown Dolomite reservoir is a heterogeneous reservoir and can be cavernous in many parts of the State, resulting in huge permeabilities. The huge voids within the reservoir make setting maximum pressures and volumes difficult to determine in this particular reservoir. Pressured water can travel long distances through faults/caverns and create problems because the pressure is not dissipated quickly as happens in sands. Normally, a disposal well can run a Step Rate Test (SRT) to determine both the maximum pressure and the well's capabilities at the various pressures. This information can then be used to determine the maximum volume and pressure to use on a UIC permit. The Brown Dolomite does not fit the radial model normally used by the UIC. After phone calls and conversations with engineers working with disposal wells in the Brown Dolomite of West Texas, I concluded that SRTs are not a practical option in Oklahoma's Brown Dolomite reservoirs. The engineers told me that it took a pump rate of 50 BPM to eventually see a break in the Brown Dolomite reservoir on an SRT, and the job could cost more than $ 100,000 to perform. This is not only expensive, but also impractical. A better method is needed to set the volume and maximum pressure limits on Brown Dolomite permits.

Many, but not all, of the recently completed Brown Dolomite disposal wells are initially capable of taking a significant volume (+/- 10,000 BWPD) of water on a vacuum for a short period of time, perhaps 6 months to 1 year. It is not until the well begins to pressure up that an accurate maximum surface pressure becomes important. Using frac gradients as a guide, a maximum surface pressure can be set, based on the depth to the top perforation, but this method is coming into question more as we dig deeper into the purge problems. Another method is to just set a maximum pressure based on experiences due to purges happening in the surrounding areas. The Texas Railroad Commission in Pampa, TX, sets a maximum volume of 10,000 BWPD with a 1000 psi maximum surface pressure and has reduced offset purges significantly. At this time, this is the best method available for setting maximum volumes and pressures until a better method can be devised.

Attachment # 2







I reviewed the well logs for both wells and was surprised to learn that some of the operators in the Beckham County area do not run open hole logs. The 4 Corners SWD # 1-20 did not run any open hole logs when it was drilled in 2012. I do not understand how the dolomite streaks can be located without the aid of open hole logs, particularly the Density-Neutron log with a P_e curve. The Canyon SWD # 1-26 did have an older Density-Neutron log available and, also, a resistivity log. From the density log, it appears the operator simply picked several of the more porous intervals to perforate. I did not see any evidence of any dolomite streaks being present anywhere in the Canyon SWD # 1 well.

A radioactive tracer log (RAT) was run in the 4 Corners SWD # 1-20 on April 9, 2019. The log indicated a flow coming into the 4 Corners well from the upper sections of the Brown Dolomite and traveling down the casing in the 4 Corners well and being disposed into deeper perforations. The depth of the saltwater entry into the 4 Corners well corresponded closely to the Canyon well perforation depths. The RAT was unable to determine exactly where the saltwater was traveling because the logging tool set down high on fill, but all the fluid was still traveling below the loggers TD reached.

A look at some of the inactive disposal wells with high shut in tubing pressures indicated that the Triggers # 1 well (API 009-21715) may have a problem. This well is located in the NE SW SE NE OF

Sec 10T9N-R21W, Beckham County, OK. The well has been shut in since 2017 with a constant 1250 psi shut in tubing pressure being reported. This well should give an accurate BHP for the Brown Dolomite reservoir, but not necessarily for the dolomite intervals. After looking at the open hole logs for the well, I could not find any dolomite present in this well. Again, I'm not sure how perfs can be picked without looking at the open hole logs and recognizing where the dolomite streaks are located. Whatever section of the Brown Dolomite is opened in this well is filled up with fluid, pressured up, and not leaking off.

An OCC Directive was issued on November 8, 2019, but only included Blaine and Kingfisher Counties in Oklahoma, not Beckham County. After a loss in of oilfield activity during 2020, due to the Covid 19 pandemic, a down turn in the economy, and a drop in oil prices, an additional Directive may be needed to include Beckham County in order to limit the volumes in the Brown Dolomite to 10,000 BWPD and the maximum surface pressure set to 1000 psi, should the economy pick back up soon. The economy automatically reduced the pressures and volumes in these wells and we are watching the decline curves to find any changes and any associated responses.